SYMAGA
SILOS

The importance of the GRAIN STORAGE and STORAGE SYSTEMS

Dubai World Trade Centre, U.A.E.
Date: 6th November

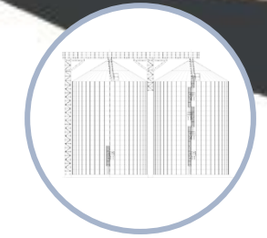
YOUR PARTNER FOR STORAGE

iaom
INTERNATIONAL ASSOCIATION OF OPERATIVE MILLERS

1.GRAIN ESSENTIAL ELEMENT

1.GRAIN ESSENTIAL ELEMENT

GRAIN REPRESENTS THE MOST IMPORTANT FEEDING ELEMENT, IN HUMAN AND ANIMAL



STORAGE IS IMPORTANT TO GUARANTEE FOOD SAFETY, ALSO PRICES STABILITY

4.000 AC

SUMERIANS

1. MEA. GRAIN ESSENTIAL ELEMENT

ESTIMATES THAT 1/3 OF THE FOOD PRODUCED
IS LOST OR WASTED ALONG THE SUPPLY CHAIN.
LOSSES ARE EVEN HIGHER IN AFRICA,
AND HAVE A NEGATIVE EFFECT ON
FOOD SECURITY, NUTRITION AND ECONOMIC STABILITY.

THE WORLD BANK

ESTIMATED THE VALUE OF
AFRICAN GRAIN LOSSES
ALONE AT USD$4B
THIS COULD FEED 1.6 BILLION
PEOPLE EACH YEAR

MENA IMPORTS

LARGEST GRAIN IMPORTING
REGION IN THE WORLD

STRATEGIES FOR IMPROVE
FOOD SECURITY, PARTICULARLY CEREALS

2. WAYS OF STORING GRAIN

BAGS

BUILDING

CONCRETE

SILO BAGS

2. WAYS OF STORING GRAIN

BULK VS BAGS

HUGE. MECHANICAL TRANSFER AND AUTOMATIC UNLOADING	**MANAGEMENT OF VOLUMES**	**SMALL. BAGS USE**
UP TO 2000 TON/H	**SPEED**	**LOW**
LIGHT LABOUR	**COST**	**INTENSIVE LABOUR**
FAST EVEN IN PORT OR AIRPORT INSTALLATIONS	**TRANSPORT**	**LARGE VOLUMES ARE NOT ALLOWED**
EASY MAINTENANCE. VENTILATION AND FUMIGATION ARE POSSIBLE	**GRAIN PRESERVATION**	**DIFFICULT MAINTENANCE. VENTILATION AND FUMIGATION ARE NOT ALLOWED**
HIGHER PROTECTION AGAINST FIRE AND RODENTS	**STORAGE RELIABILITY**	**LOWER PROTECTION AGAINST FIRE AND RODENTS**

2. WAYS OF STORING GRAIN

METALIC SILO VS BUILDING

LOWER	REQUIRED AREA	HIGHER
BETER OPTIMIZATION. TOTAL AUTOMATION	HANDLING	DIFFICULT. NOT TOTAL AUTOMATION
LESS PER STORED TON. MENOR POR TON.	INVESTMENT	HIGHER PER STORED TON.
EASY MAINTENANCE. POSSIBILITY OF VENTILATION, FUMIGATION	GRAIN PRESERVATION	DIFFICULT MAINTENANCE. VENTILATION AND FUMIGATION ARE NOT ALLOWED
HIGHER PROTECTION AGAINST FIRE, RODENTS AND INSECTS	STORAGE RELIABILITY	HIGHER PROTECTION AGAINST FIRE, RODENTS AND INSECTS

2. WAYS OF STORING GRAIN

METALIC SILO VS CONCRETE

FAST AND SIMPLE. By screws	**INSTALLATION**	**SLOW AND DIFFICULT**
FAST	**INSTALLATION**	**SLOW**
ALMOST NON-EXISTENT	**MAINTENANCE**	**HIGHER**
LOWER	**INVESTMENT**	**HIGHER**

2. WAYS OF STORING GRAIN

METALIC SILO VS BAGS

HIGHER IN LOWER AREA	STORAGE CAPACITY	LOWER
MECHANICAL TRANSFER AND AUTOMATIC UNLOADING	MANAGEMENT OF VOLUMES	DIFFICULT DISCHARGE. UN AUTOMATED
EASY MAINTENANCE. POSSIBILITY OF VENTILATION, FUMIGATION. CONTROL	GRAIN PRESERVATION	DIFFICULT MAINTENANCE. VENTILATION AND FUMIGATION ARE NOT ALLOWED
HIGHER PROTECTION AGAINST HUMIDITY, FIRE AND RODENTS	STORAGE RELIABILITY	LOWER PROTECTION AGAINST HUMIDITY, FIRE AND RODENTS
HIGHER	DURABILITY	LOWER
HIGHER	INVESTMENT	LOWER
UP TO 2000 TONS/H	SPEED	LOW
LOWER	OPERATIVE COST PER TONS	HIGHER
HUGE VOLUME	TRANSPORT	LOW VOLUME

3. METALIC SILO ADVANTAGES

3.METALIC SILO ADVANTAGES

18.750 TONS

GREAT STORAGE SAVING SPACE

from 20 m³ up 25,000 m³

€

ECONOMICAL EASY ASSEMBLY & MAINTENANCE

> investment & maintenance

> Resources: economic & human

POST HARVEST

LOSSES

QUALITY

EFECTIVE PROTECTION

AGAINST

WHEATHER, RODENTS & INSECTS

3.METALIC SILO ADVANTAGES

LARGE PERIODS

CONTROL AUTOMATION

HUMIDITY CONTROL
TEMPERATURE, ETC

AUTOMATIC

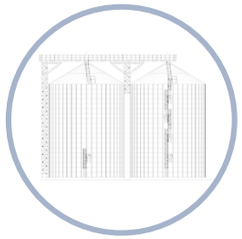
LOAD & DOWLOAD

HANDING SPEED

IMPROVE PORT ACTIVITY

4. GRAIN PRESERVATION

4.GRAIN PRESERVATION



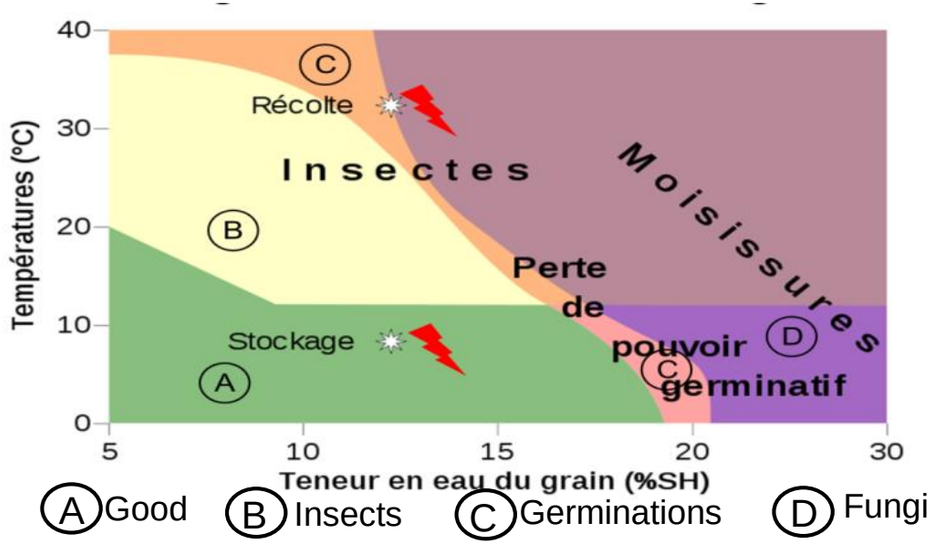
STORING IN METALIC SILOS
IMPROVES GRAIN PRESERVATION

MAIN RISK FACTORS

- TEMPERATURE
- HUMIDITY

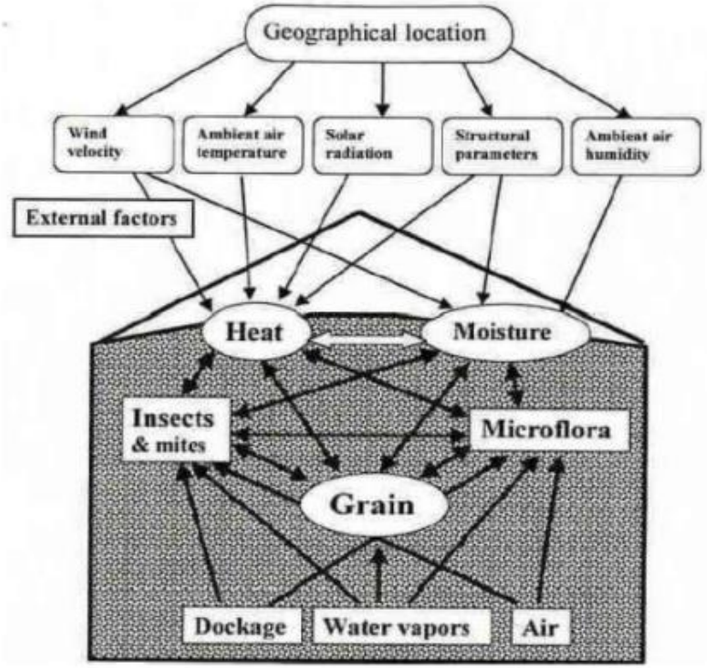
- INSECTS

Grain preservation diagram



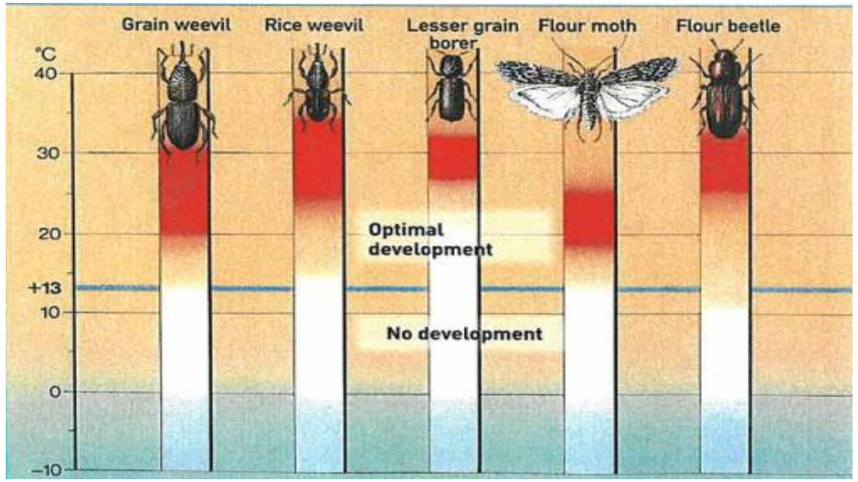
A Good B Insects C Germinations D Fungi

Factors affecting heat transfer

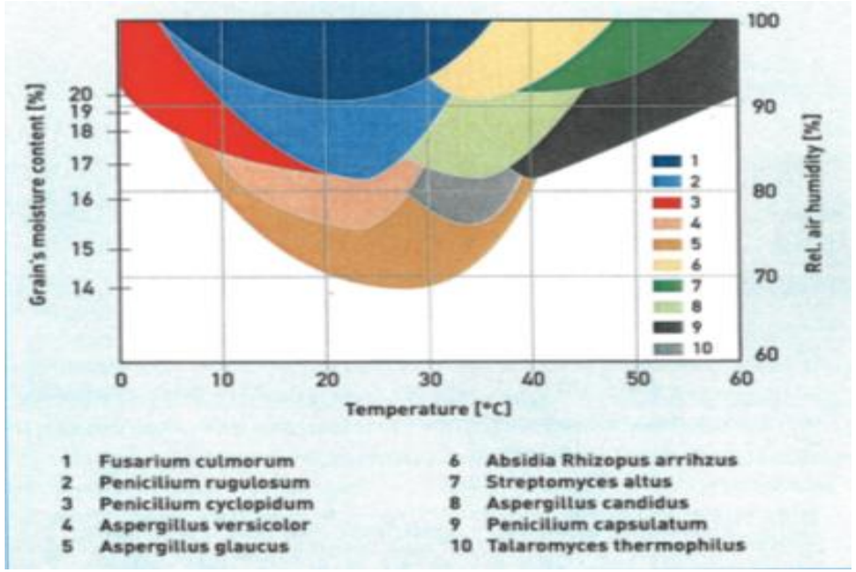


4.GRAIN PRESERVATION

Generation of species depending on temperature



Generation of organisms depending on humidity and temperature

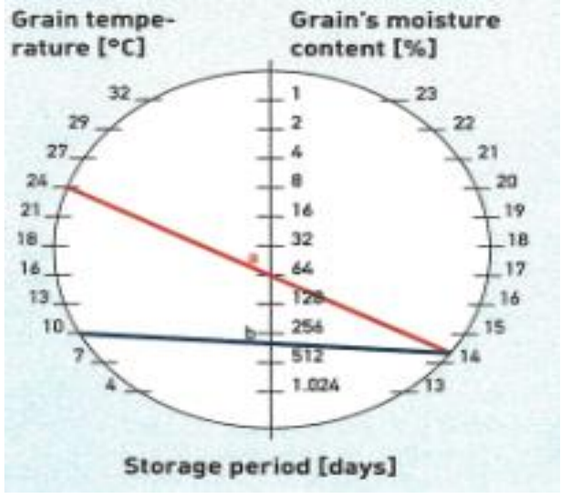


4.GRAIN PRESERVATION

Reliable storage depending on temperature and humidity. Tropical and Continental area

Climate zone / Moisture content [%]	temperate* [months]	tropics** [months]
12 – 15	8 – 12	6 – 8
15 – 17	6 – 10	3 – 5
17 – 19	4 – 6	1 – 2
19 – 21	1 – 4	0.5 – 1

* Primary cooling to 10 °C for Europe
** Primary cooling to 15 °C e.g. for Latin America and Asia



Secure preservation in different grain types

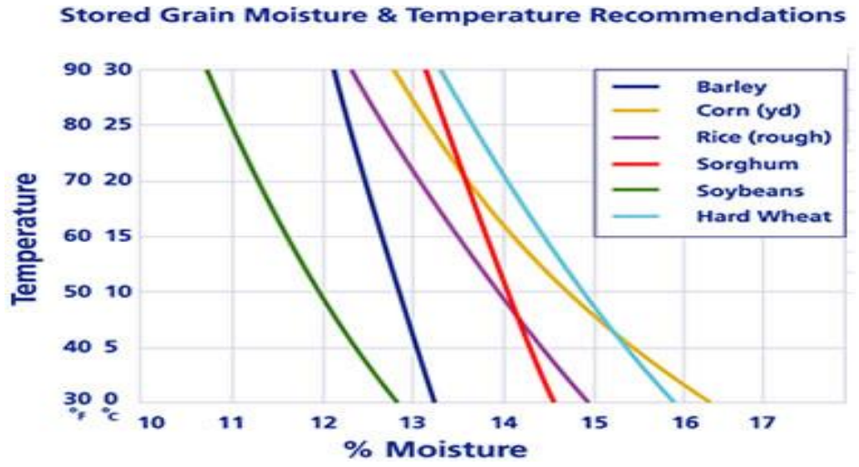
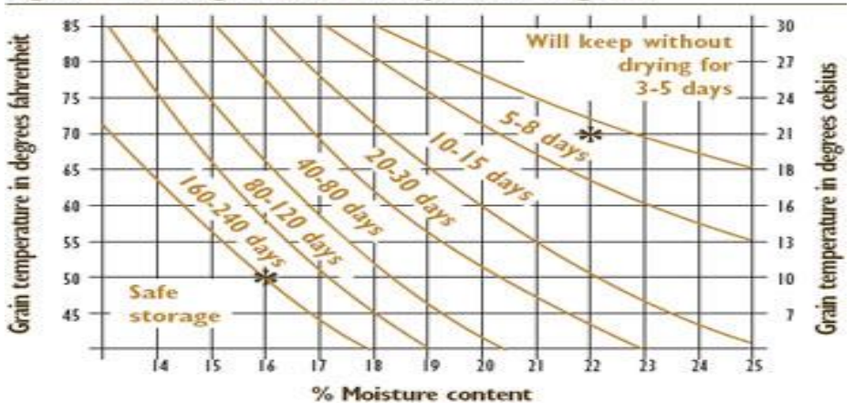


Figure 1 – Storage time and temperature of grains.



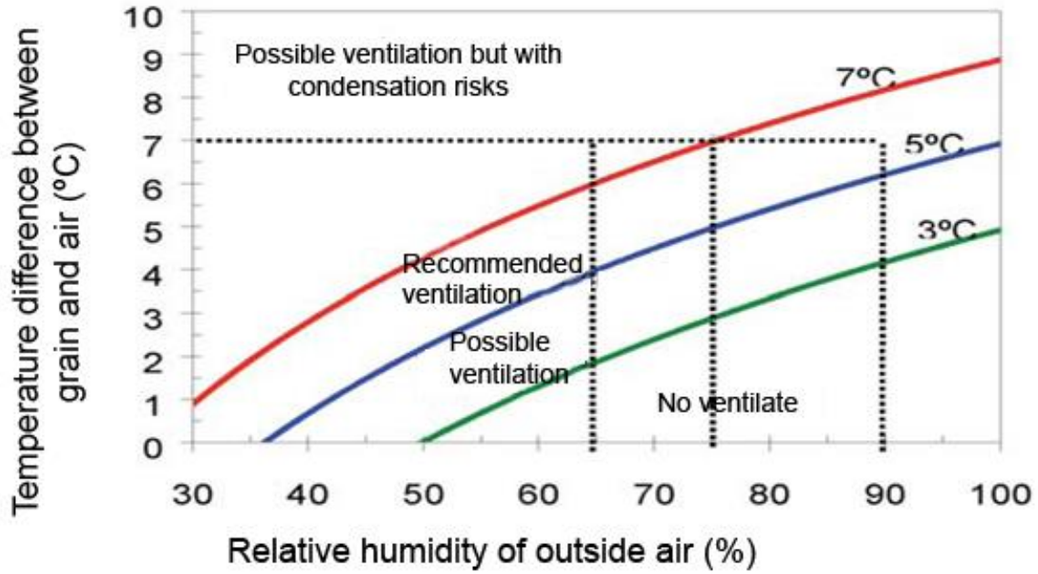
4.GRAIN PRESERVATION

Ventilation, control instrument.

DEPENDS ON:

- HUMIDITY OF EXTERNAL AIR

- TEMPERATURE DIFFERENCE BETWEEN GRAIN & EXTERNAL AIR



5. RAW MATERIAL

5.RAW MATERIAL

Quality Certification

Total Control traceability
Own Software
Standard Quality

acero
S350GD
S280GD

According to EN 10346

coating
Z600
ZM310
g/m²

Galvanization 37% more than standard

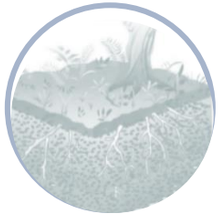
Permanent Stock 12,000 tons

5.RAW MATERIAL.GALVANIZATION

Silo durability depends on environmental corrosion and external factors:

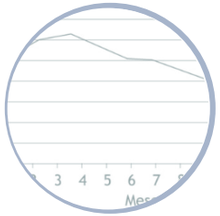
- TEMPERATURE HUMIDTY

- SOIL ACIDITY



- CORROSIVE ATMOSPHERE

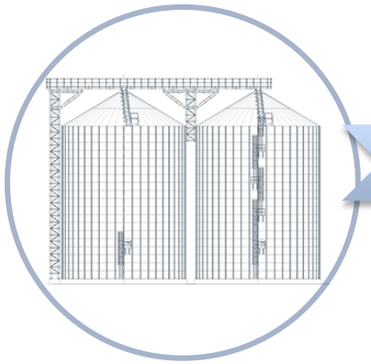
- SALINITY OF THE AIR



The galvanization is a process to protect steel against corrosion. This process consists in applying a layer of zinc (and/or aluminum and magnesium) to avoid oxidization inflicted by external factors.

Galvanization = Durability

GALVANIZATION: Comparison

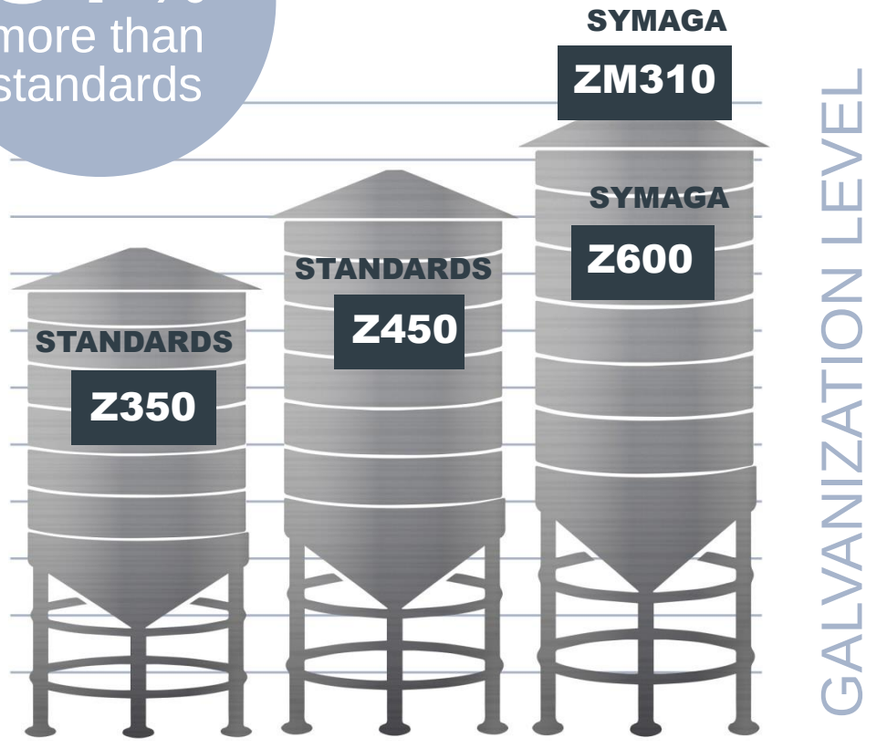


SYMAGA SILOS

600 g/m² coating of zinc

up to 37% more than standards

UNE-EN 36130	USA A653	g/m²	
Z600	G210	600	SYMAGA SILOS
Z450		450	Others
	G140	427	
Z350	G115	350	Standards
Z270	G90	270	



GALVANIZATION. INTERNATIONAL NORM. ISO 9223, 9224 and 9225

SYMAGA SILOS

ISO 9223 Atmospherical Categories C1 to C5

CATEGORY	Corrosivity	Average loss of Zink per year in µm
C1	Very Low	0,1
C2	Low	0,1 to 0,7
C3	Medium	0,7 to 2,1
C4	High	2,1 to 4,2
C5	Very High	4,2 to 8,4

*Z450: 31µm ; Z600: 42µm

Corrosion and yearly thickness losses of galvanic coating, microns per year (µm/year) of zinc coating

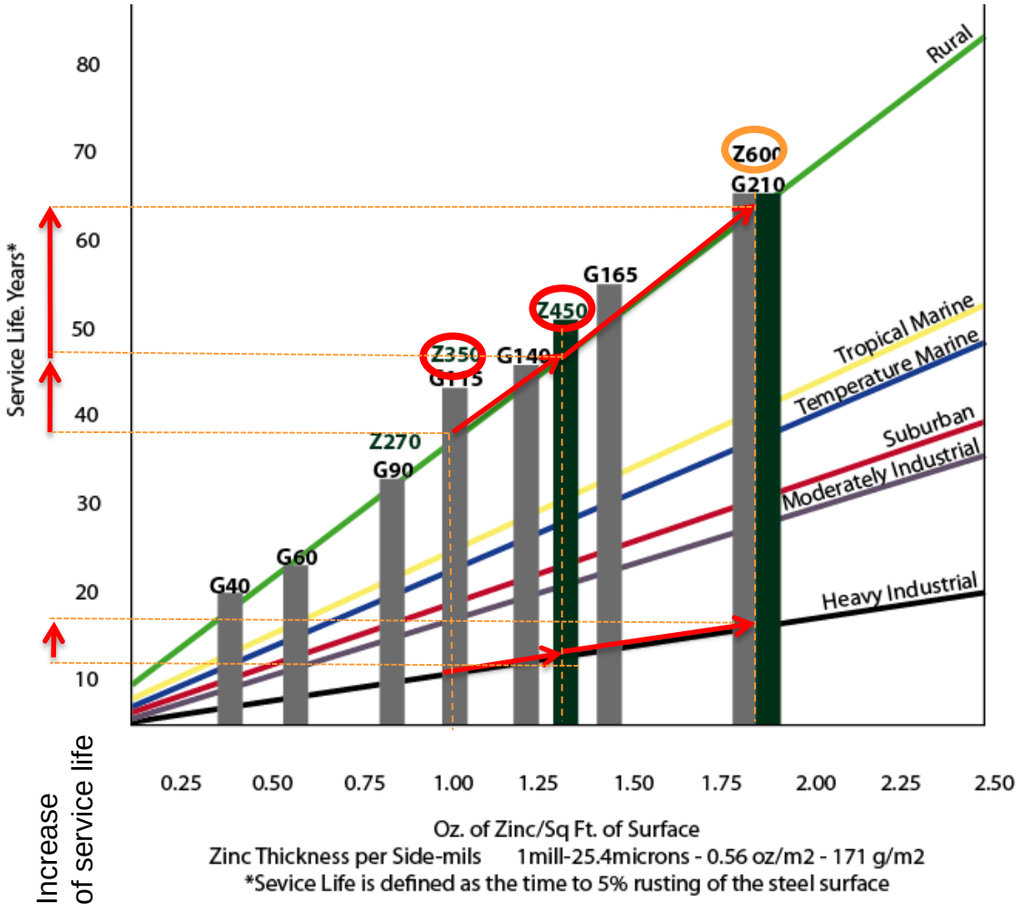
The highest zinc layer thickness, the highest service life

GALVANIZATION. INTERNATIONAL NORM. ISO 9223, 9224 and 9225

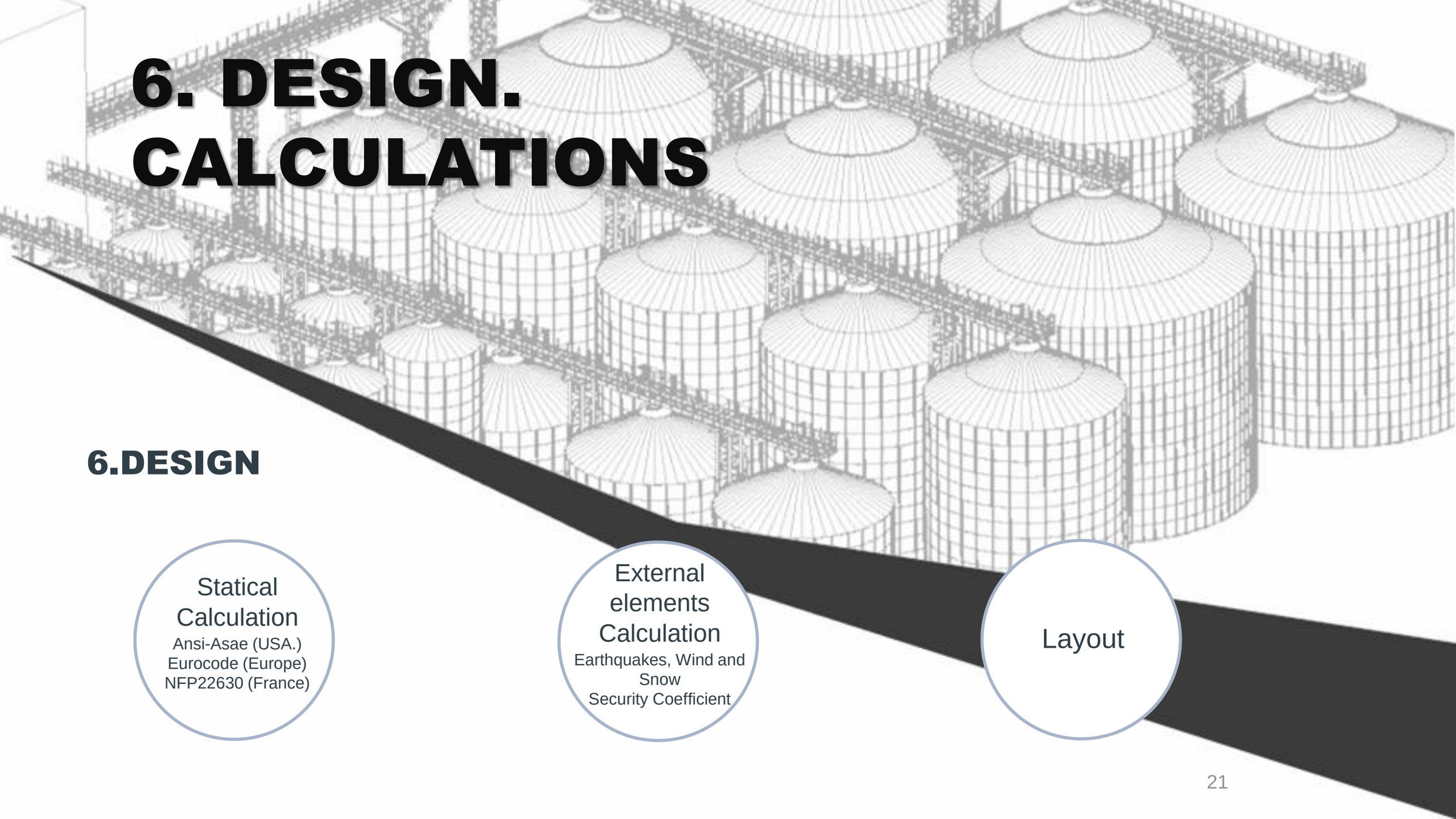
SYMAGA SILOS

ISO 9224 Atmospheric for metals & alloys → Atmospheric corrosiveness reference value for metals and alloys

ISO 9225 Pollution for corrosiveness → Pollution measure for atmospheric corrosiveness for metals and alloys



6. DESIGN. CALCULATIONS



6.DESIGN

Statical Calculation

Ansi-Asae (USA.)
Eurocode (Europe)
NFP22630 (France)

External elements Calculation

Earthquakes, Wind and Snow
Security Coefficient

Layout

6.DESIGN. CALCULATIONS

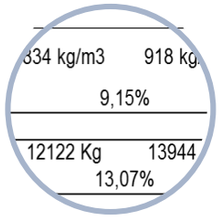
INTERNAL:

GRAIN LOAD

- ANGLE OF REPOSE
- SPECIFIC WEIGHT
- INTERNAL FRICTION

SPECIFIC WEIGHT

- EXCLUDING GRAIN



SECURITY COEFFICIENT

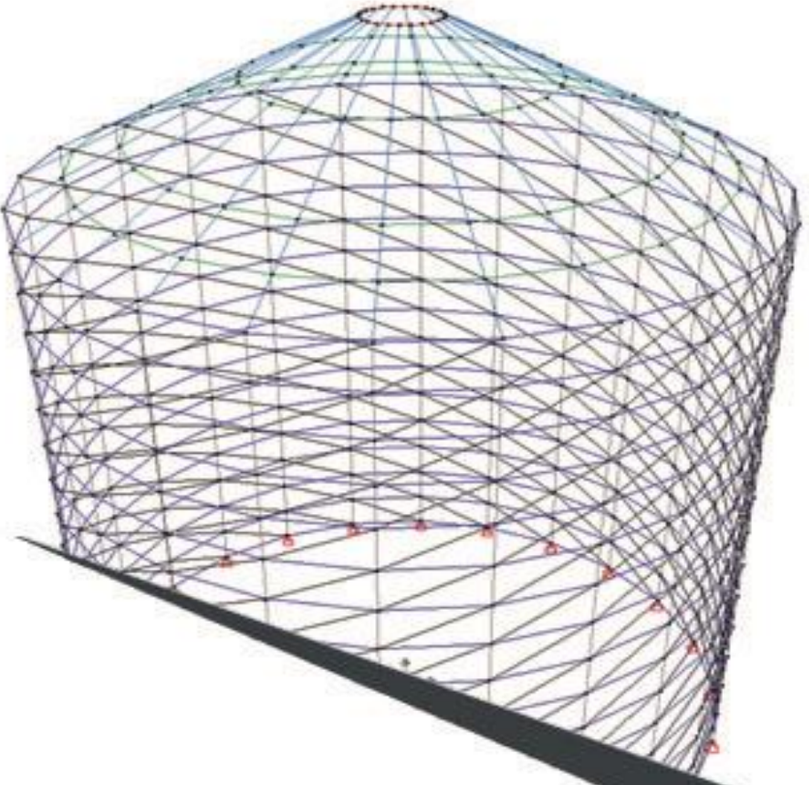
Calculated with S.W.	834 kg/m3	918 kg/m3
Difference	9,15%	
Silo weight	12122 Kg	13944 Kg
Difference	13,07%	

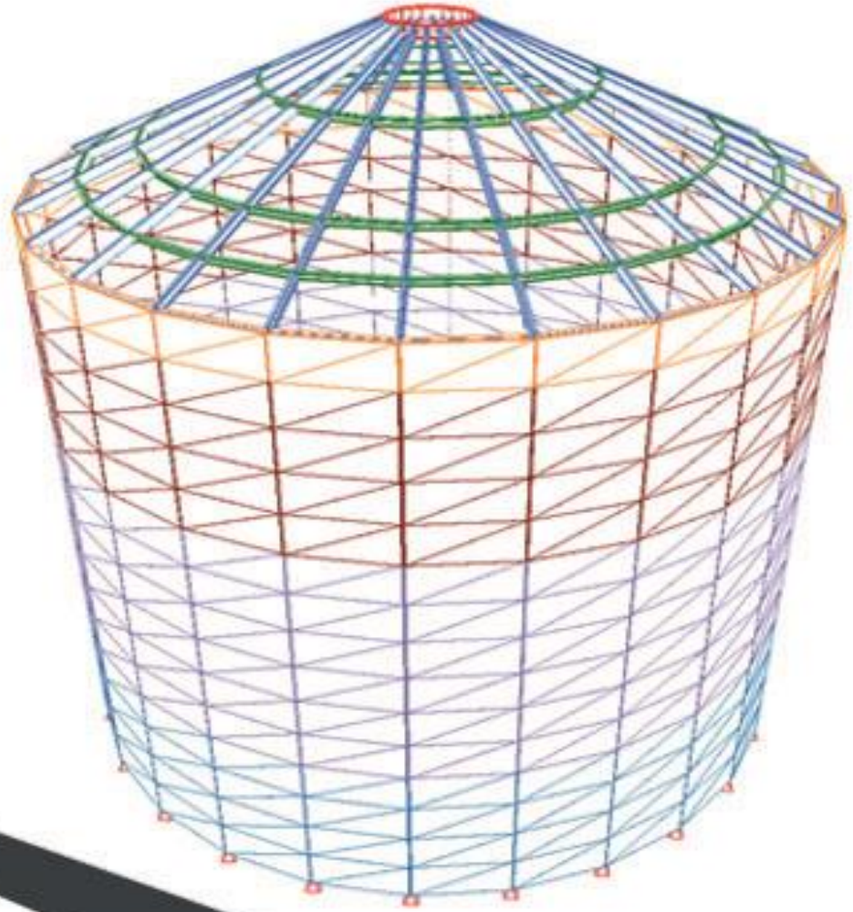
EXTERNAL:

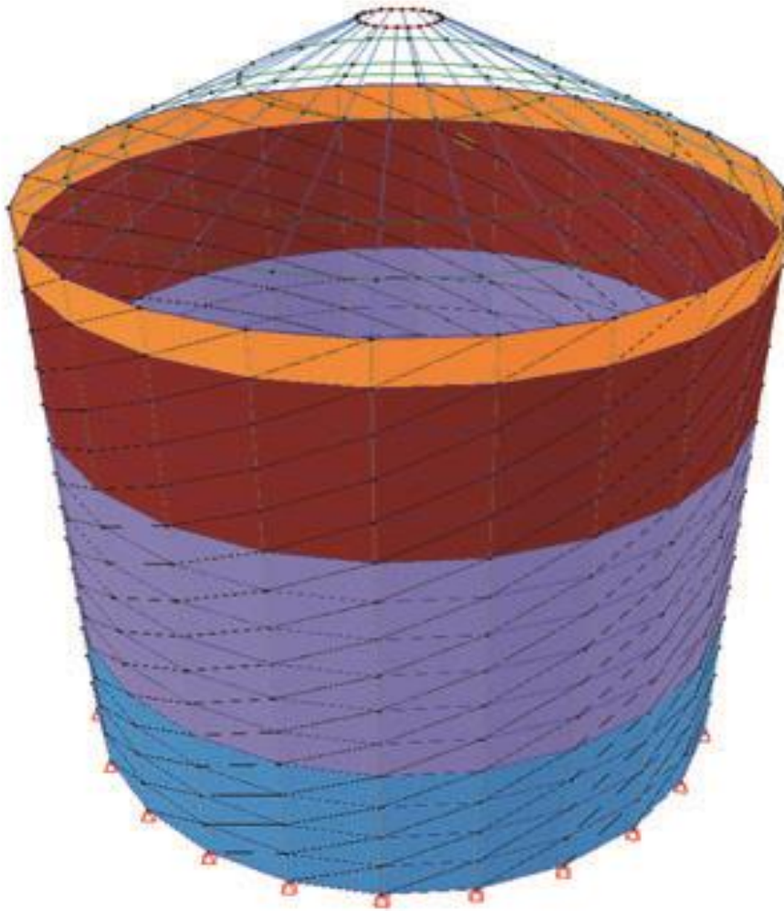
EARTHQUAKES

WIND

SNOW







6.CALCULATION

American regulation
ANSI-ANSAE

Density calculation
ρ = 834 kg/m3*
*regardless of the stored material
(barley ρ = 650, malt ρ = 540, e)
Calculations based on “Jensen formula”

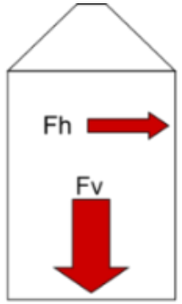
Under requirement CALCULATION IN ANY CODE

EURODE (Europe)
NFP22630 (France)
GOST 25627-(1983 (Russia)

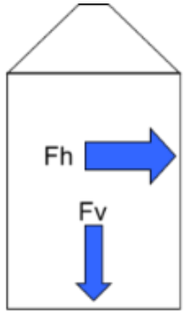
SECURITY COEFFIENT CALCULATION OVER REGULATION

Bodysheets + 9 Tons
Stiffeners: + 4 Tons
*Bodysheets absorb horizontal loads,
and stiffeners absorb vertical loads

EUROCODE AND ANSI DIFFERENCES. LOAD COMPARISON

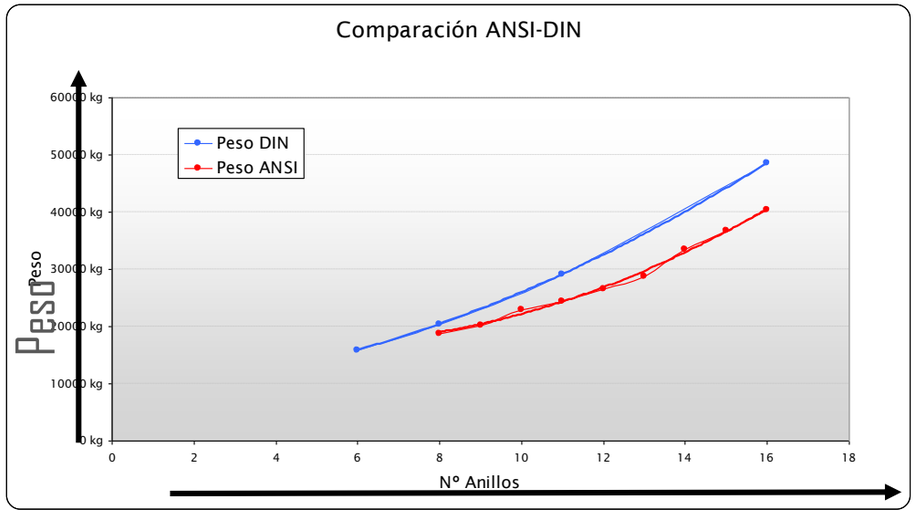


EUROCODE LOADS



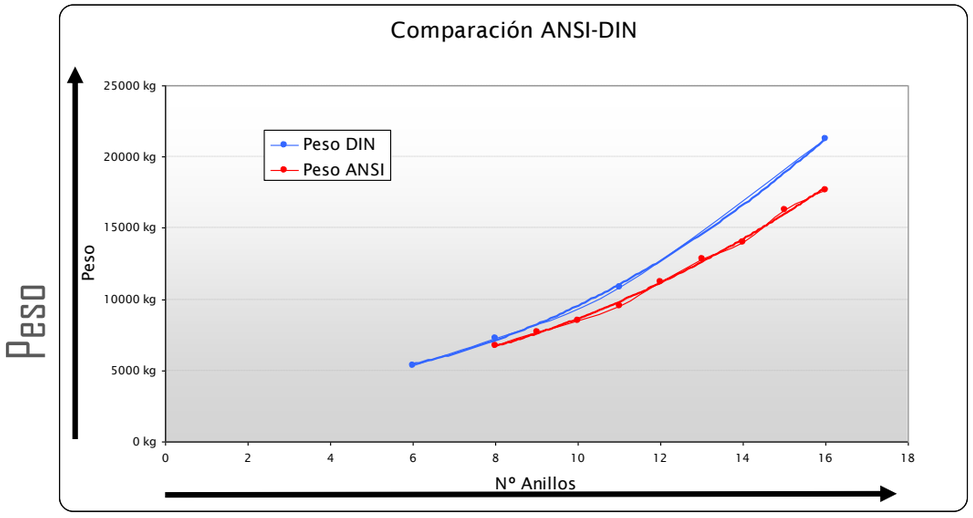
ANSI LOADS

SILO Ø 18,34 m



Height

SILO Ø 12,23 m



Height

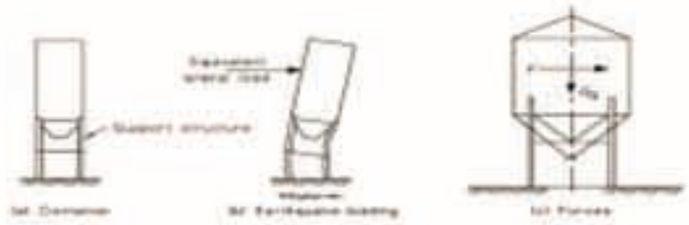


FIGURE 7.2 FUNDAMENTAL VIBRATION MODE FOR ELEVATED CONTAINERS

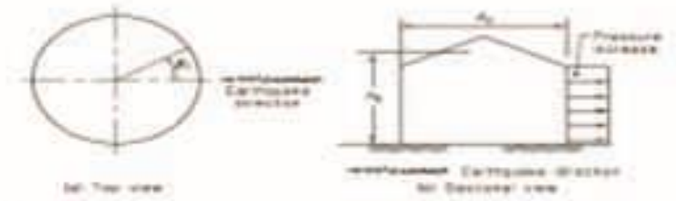
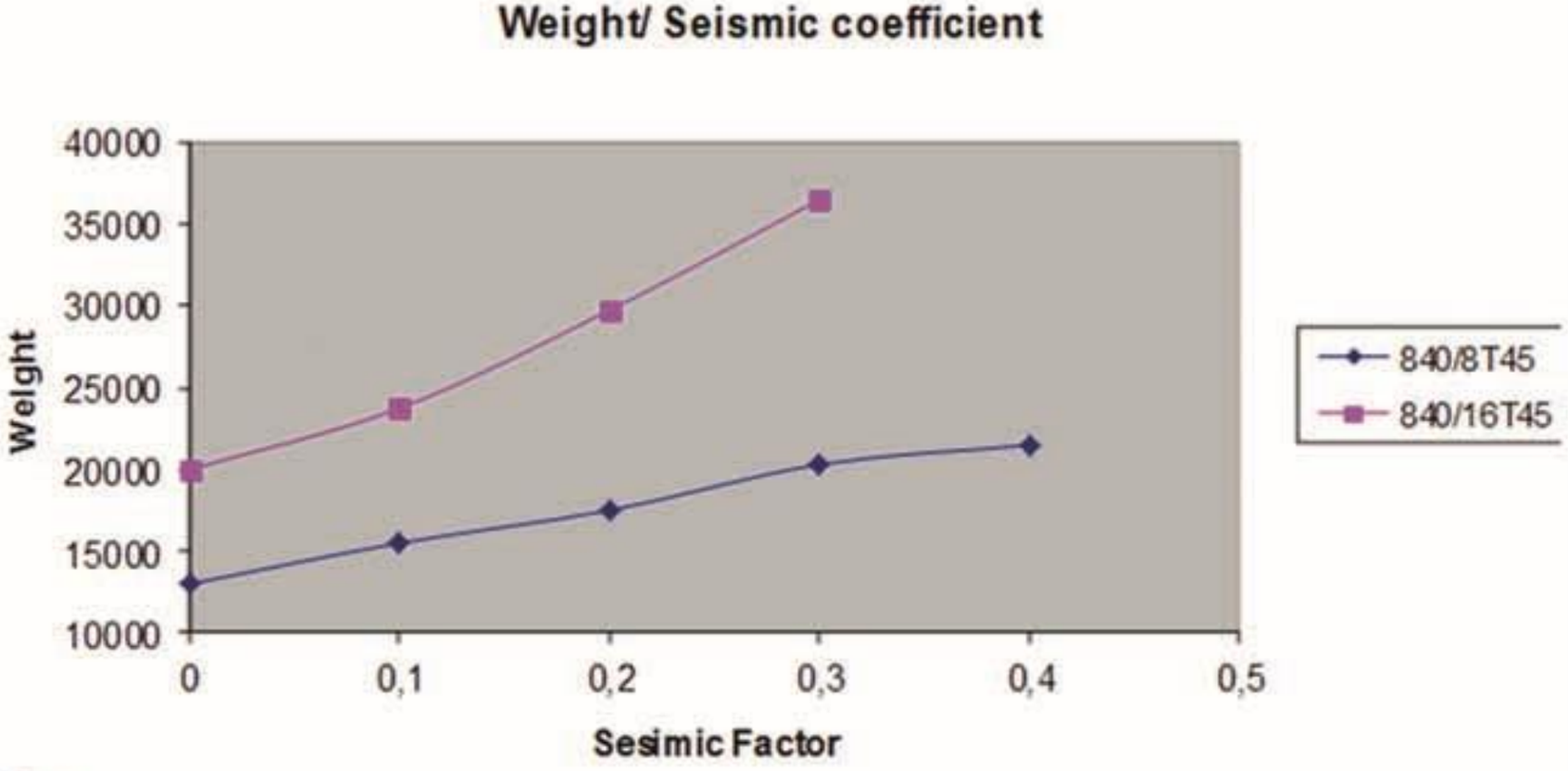


FIGURE 7.3 PRESSURES ON GROUND-SUPPORTED CONTAINERS DURING EARTHQUAKES



6.EXTERNAL ELEMENTS. SEISMIC

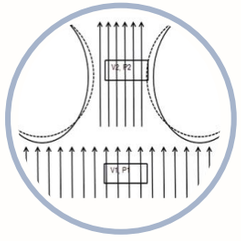
Apply **seismic coefficient**

Number we multiply that by silo mass calculating the strength caused by earthquake

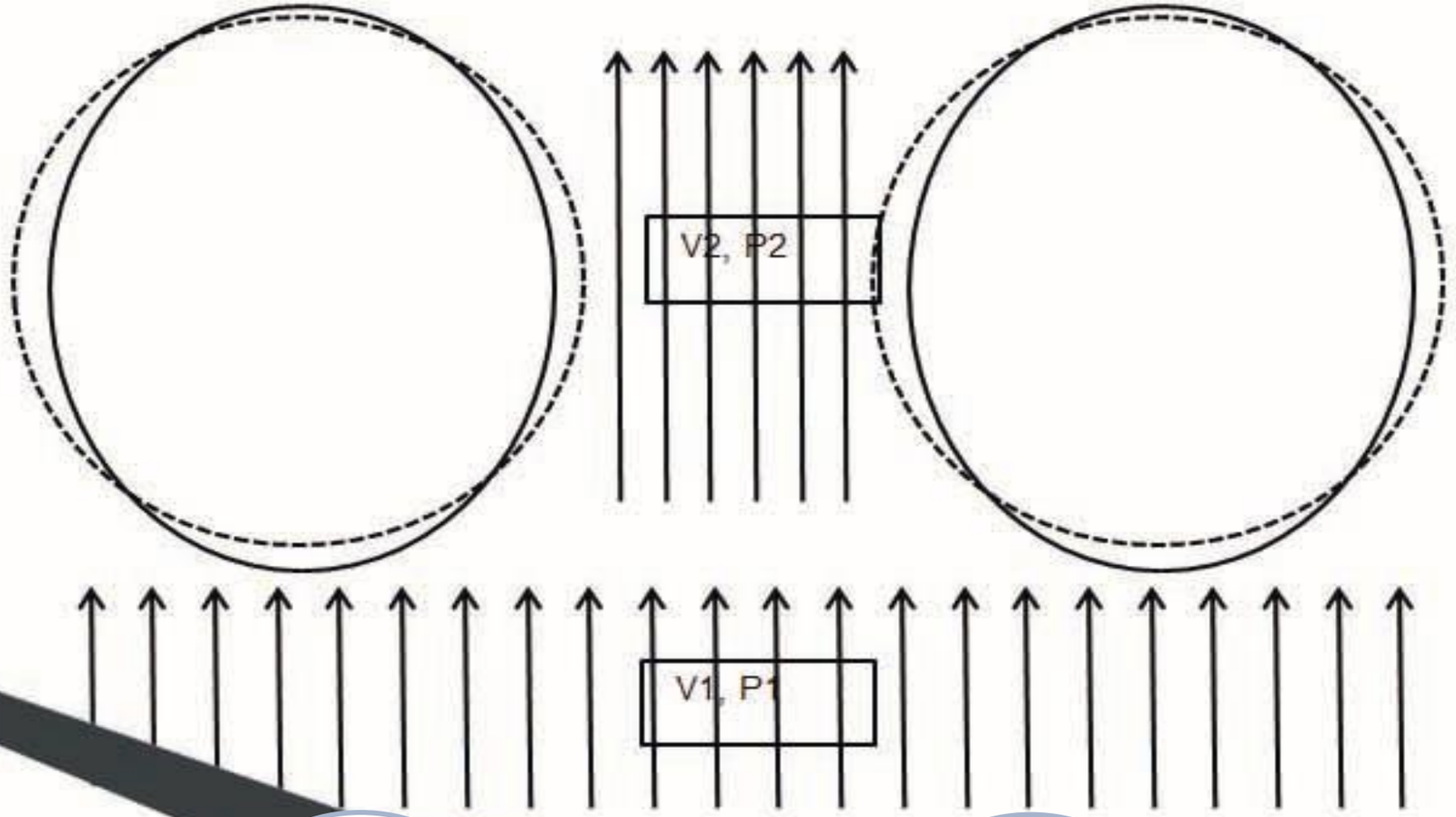
CORRECT DESIGN

INCORRECT DESIGN

6.EXTERNAL ELEMENTS. WIND



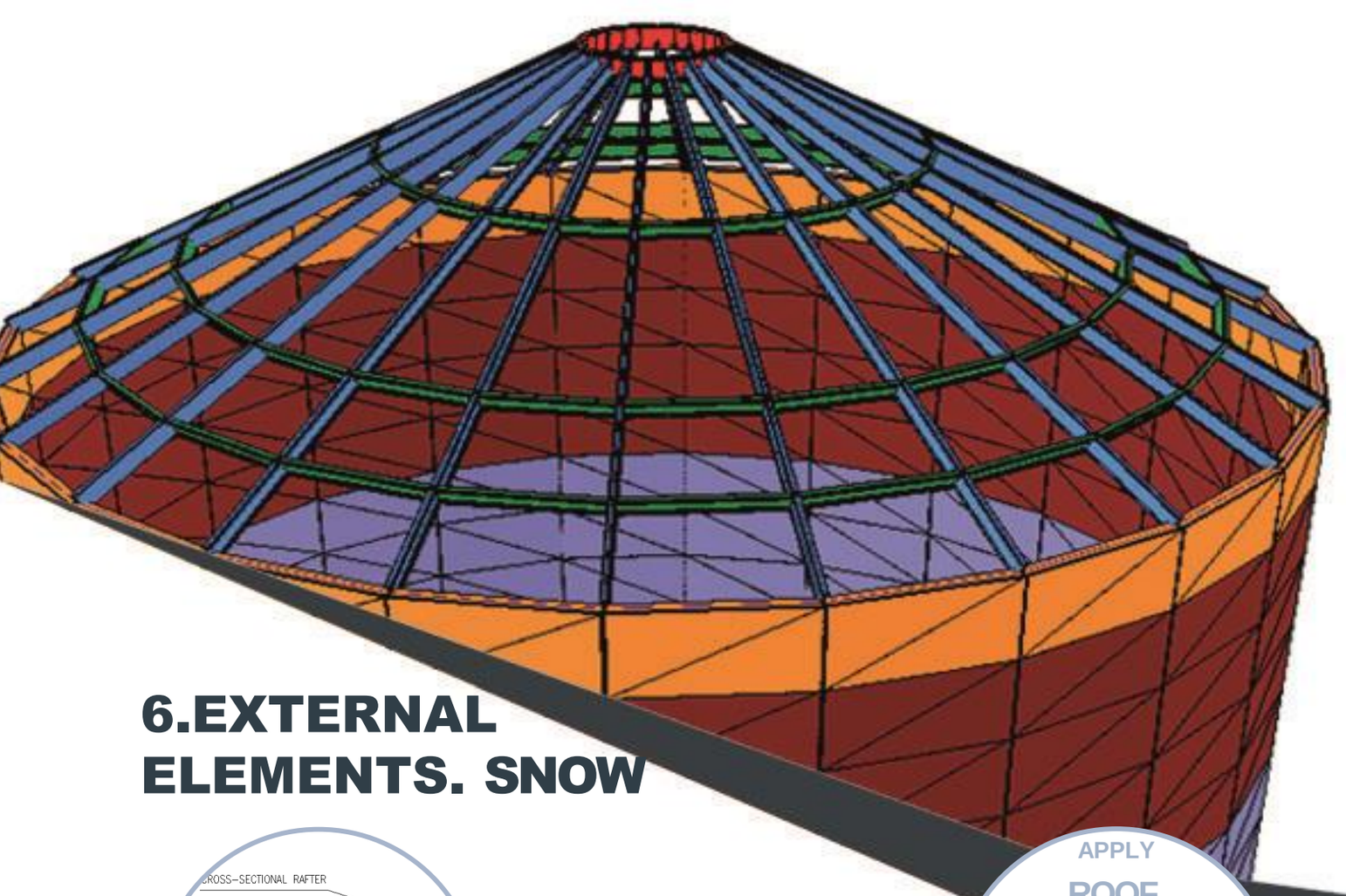
Wind increases its speed
between silos,
creating additional pressure

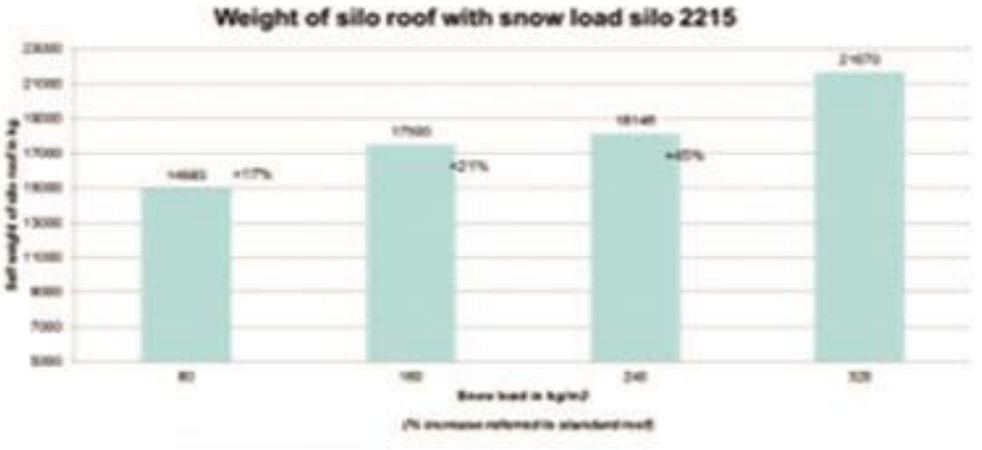


**REINFORCE-
MENTS
+ WIND RINGS**

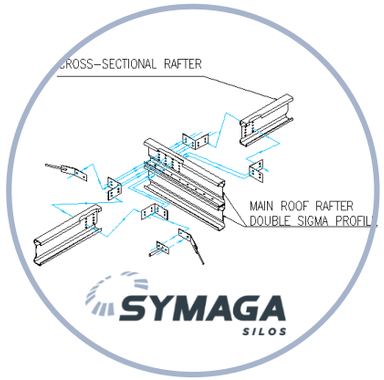
SYMAGA SILOS

INCORRECT DESIGN





6.EXTERNAL ELEMENTS. SNOW



APPLY

ROOF REINFORCEMENT silo > 24,44 DOUBLE PROFILE Σ (2,5 – 3 mm) AS MAIN ROOF BEAMS

CORRECT DESIGN

INCORRECT DESIGN

7. GENERAL MAINTENACE

7. MAINTENANCE

Strictly follow the
first filling procedures
(especially center load).

Check temperature
& moisture
of grain
at regular intervals

After discharging,
clean the inside of the silo
thoroughly


SYMAGA
SILOS
THANKS
RELIABLE
Dubai World Trade Centre, U.A.E.
Date: 6th November
YOUR PARTNER FOR STORAGE
iaom
INTERNATIONAL ASSOCIATION
OF OPERATIVE MILLERS